

In the Matter of)
)
Review of the Commission's Ruling)
Regarding the Pricing of Unbundled) WC Docket No. 03-173
Network Elements and the Resale of)
Service by Incumbent Local Exchange)
Carriers)

1. My name is Thomas W. Hazlett. I am a Senior Fellow at the Manhattan Institute for Policy Research, and a former Chief Economist of the Federal Communications Commission. Attachment 1 is a copy of my curriculum vitae.

2. My name is Arthur M. Havenner. I am a Professor of Agricultural and Resource Economics at the University of California, Davis. Attachment 2 is a copy of my curriculum vitae.

3. My name is Coleman Bazelon. I am a Vice President of Analysis Group, Inc. Attachment 3 is a copy of my curriculum vitae.

4. In a previous Declaration, we evaluated the effect that TELRIC (“total element long-run incremental cost”) pricing for mandated network sharing is having on telecommunications investment.¹ Attachment 4 is a copy of that Declaration. We found that investment by both incumbent telephone carriers, which face network sharing obligations, and by competitive entrants into local markets, which ostensibly benefit from mandates promoting wholesale access to network elements, has decreased substantially due to these regulatory policies. In addition, we critiqued a Phoenix Center paper claiming that network sharing mandates increased investment by incumbent phone carriers.²

5. We have been asked by Verizon to update our previous analysis and to evaluate three studies of the relationship between telecommunications investment and network sharing policies that have appeared since our previous analysis was conducted. Section I

¹ Thomas W. Hazlett, Arthur M. Havenner, and Coleman Bazelon, *Declaration Submitted to the Federal Communications Commission by Verizon Communications*, WC Docket No. 03-157 (September 2, 2003) ["HHB 2003"].

² PHOENIX CENTER POLICY BULLETIN NO. 5, *Competition and Bell Company Investment in Telecommunications Plant: The Effects of UNE-P* (Originally released July 9, 2003 and updated September 17, 2003) ["PHOENIX 5"]

provides an introduction and summary of our findings. Section II reviews mounting evidence that the rising use of UNE-P at TELRIC rates discourages telecommunications network investment, imposing inefficiencies that lower consumer welfare. Section III shows how a September 2003 study by the Phoenix Center³ misinterprets its own empirical estimates, while failing to produce any factual support for its conclusion that TELRIC-priced UNE-P entry increases investment. Section IV demonstrates that an October 2003 Consumer Federation of America (CFA) paper⁴ reaches its conclusion that consumer gains from TELRIC-priced UNE-P exceed \$5 billion a year by ignoring the basic economic trade-offs involved in network sharing rules. Section V critiques a September 2003 paper sponsored by AT&T⁵ that is fatally flawed in its analysis of competition, as well as in its presentation of a game theory simulation of a twenty-year mandatory unbundling regime that confuses costs with investment, producing meaningless results.

I. Introduction and Summary

6. The methodology used to determine regulated wholesale rates is an important determinant of how competition will develop.⁶ These prices are crucial to the decisions that various market participants – ILECs, CLECs, investors, and others – make. All roads do not lead to the same economic outcome. A balance must be struck between terms and conditions that encourage entry (by reducing inefficient barriers), and those that discourage investment (by undermining the value of risky assets committed to providing telecommunications network services). Hence, the pro-consumer objective cannot be to maximize entry or to minimize short-run prices, but must be to encourage efficient forms of competition over the long term.

7. Inefficient forms of competition do not enhance consumer welfare. For instance, were rules to encourage resale modes of entry but discourage investment in new facilities (by entrants or incumbents), there might be retail price competition. But the net result could well be negative for customers. The cost of providing retail service would increase, due to increased marketing costs; efficiencies from vertical integration would be lost; and long-term benefits from the creation of improved, or additional, network infrastructure would be lost. This is why the argument for mandatory network sharing rules has been based on the “stepping stone” theory.⁷ This theory posits that allowing entrants to rent some pieces of the network that are particularly difficult to replicate at an

³ PHOENIX CENTER POLICY BULLETIN NO 6 *UNE-P Drives Bell Investment – A Synthesis Model* (September 17, 2003) [“PHOENIX 6”].

⁴ Consumer Federation of America, *Competition at the Crossroads: Can Public Utility Commissions Save Local Phone Competition?* (October 7, 2003) [“CFA 2003”].

⁵ Kevin Hassett, Zoya Ivanova, and Lawrence J. Kotlikoff, *Increased Investment, Lower Prices – the Fruits of Past and Future Telecom Competition* (September 2003) [“HIK 2003”].

⁶ Of course, the implementation of that methodology is also critical. The manner in which individual states have implemented TELRIC has produced widely varying rates. For example, the UNE-P discount (from retail) is set as low as \$4.64 in Arizona, to as much as \$35.06 in Arkansas. UBS Warburg, *How Much Pain from UNE-P?* (August 20, 2002), Table 5.

⁷ Gregory L. Rosston and Roger G. Noll, *The Economics of the Supreme Court’s Decision on Forward Looking Costs*, 1 REVIEW OF NETWORK ECONOMICS (September 2002): 81-89, p. 88.

initial stage of competition provides an impetus to those entrants investing in their own facilities over time. Before long, rival networks are created and regulation of wholesale terms can be removed.

8. While low prices are good for consumers, all else equal, all else will not be equal when wholesale price regulation undermines investment incentives or otherwise leads network owners to reduce service quality. It is not an efficient outcome when consumers' bills for service decline but these declines are offset by lower service quality or capital depreciation (which implies lower quality and/or higher prices in future periods). In fact, policies that favor short-term price discounts at the expense of long-term capital investment tend to be highly inefficient because they distort the balance between the quality/price bundle available to consumers today and choices available in the future. And, in disrupting investment in new networks, they undermine the emergence of competitive market forces that promise to bring much greater consumer benefits than are available in today's regulated marketplace.

9. There has been considerable debate over how to establish a wholesale pricing structure that strikes the proper balance between competitive entry, on the one hand, and anti-consumer reductions in network infrastructure, on the other. The current method for calculating the regulated wholesale price, TELRIC, has been adopted by regulators and will be re-evaluated in this proceeding. Based on our examination of the available evidence, we conclude that the net effect of TELRIC pricing has been to discourage investment in network infrastructure by both ILECs and CLECs, and that such regulated rates have failed to bolster incentives to create new competitive networks.

10. In this paper, we examine additional evidence that TELRIC is deterring investment. We also respond to three recent papers purporting to show that TELRIC prices increase investment and consumer welfare. The new Phoenix Center analysis misinterprets its own results. When properly evaluated, its conclusion of a positive relationship between investment and UNE-P line growth vanishes. The CFA study, which calculates consumer benefits of over \$5 billion annually from current network sharing mandates, is shown to be economically meaningless: the study focuses solely on short-run price discounts, while ignoring alternative sources of competition as well as the level of network investment by ILECs and CLECs. The HIK paper claims that lowering TELRIC prices would increase consumer welfare, but misinterprets the empirical evidence it offers, presents an erroneous economic theory, and conducts a game theory exercise in which wholesale rate regulation is assumed to offer the exclusive form of voice telephone competition for twenty years into the future. As we show, none of these papers offers credible evidence bearing on the actual relationship between TELRIC pricing, on the one hand, and consumer welfare, on the other.

II. Evidence That TELRIC Pricing Discourages Investment in Networks

11. In our previous paper, we examined economic evidence on the relationship between current network sharing policies and network investment. We concluded that the availability of UNE-P at TELRIC prices appeared to be having a strongly negative

impact on telecommunications investment. We will briefly review the basic evidence here and expand the analysis by including recent data on telephone company investment patterns and the results of a new regression analysis we performed on the relationship between CLEC-owned lines and UNE-P lines.

12. Between year-end 2000 and year-end 2002, UNE-P lines grew over 220%, while CLEC-owned lines grew just over 20%.⁸ When the subset of competitive lines provided via cable telephony is excluded, CLEC-owned lines actually declined. See Figure 1. During this period, UNE rates (and, therefore, UNE-P prices) have been dramatically lowered in many states, and it appears clear that this reduction in price has helped drive the increase in UNE-P lines.⁹ During this same period, both ILEC and CLEC investments have plummeted. For instance, from 2001 to 2002, the total net capital stock of the three Bell operating companies (excluding Qwest, which reported its 2002 data too late to include in the current analysis) fell by 7%, indicating a remarkably high level of disinvestment.¹⁰ CLEC capital spending declined from 49% of revenues in 2000 to 14% of revenues in 2002.¹¹ These reductions contrast with the experience in other communications sectors not subject to similar network sharing rules. For instance, although investment by wireless carriers and cable operators decreased in 2002 compared to 2001, investment in those sectors remains well above pre-bubble levels. Local phone networks, in contrast, are investing less in 2002 (even without adjusting for inflation or population increases) than in 1996.¹²

13. By 2003, the quarterly capital expenditure data reported by the Bell companies fell below replacement level.¹³ Investment analysts predict that investment may fall further in 2004.¹⁴ These abnormally low capital expenditures are particularly striking, given the significant rebound in overall economic growth. For example, the third quarter of 2003 saw the strongest GDP performance in two decades.¹⁵ Independent analysts blame disincentives associated with TELRIC regulation for lagging investment in telecommunications: “Near-term ramp-up in capital equipment is unlikely... [N]ew investment in the traditional wireline business will likely be constrained due to the extension of the UNE-P regime.”¹⁶ Analysts likewise conclude that unbundling rules diminish the ability of new entrants to build rival networks: “Rather than incent

⁸ A CLEC-owned line involves local phone services delivered entirely over a competitive, non-ILEC network.

⁹ *Local Telephone Competition: Status as of December 31, 2002*, Federal Communications Commission, Wireline Competition Bureau (June 2003).

¹⁰ HHB 2003, Figure 5

¹¹ HHB 2003, Figure 2.

¹² HHB 2003, pp. 4-8

¹³ HHB 2003, Figure 4.

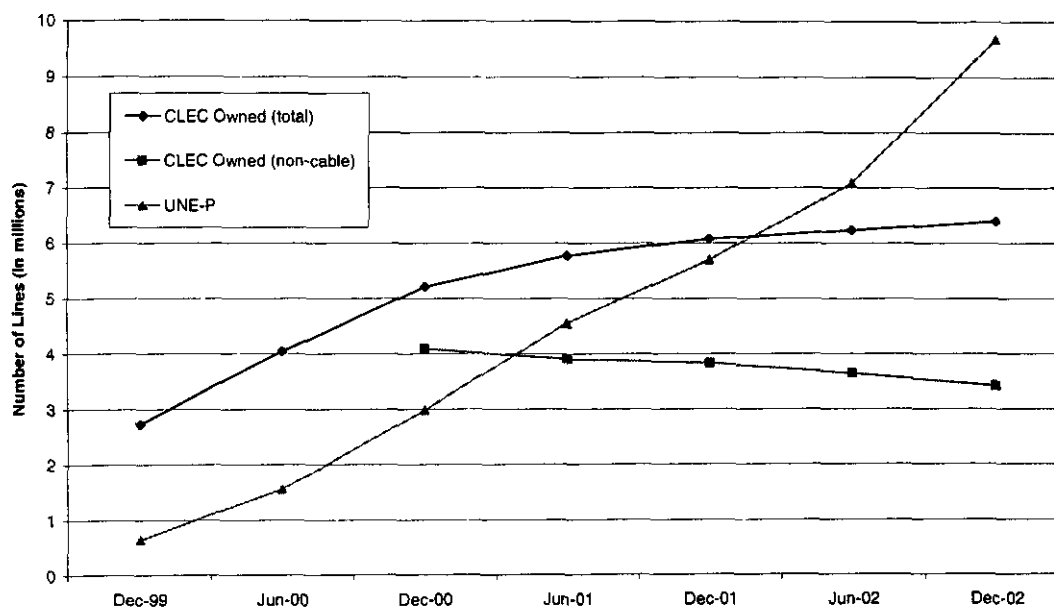
¹⁴ Merrill Lynch Global Securities Research & Economics Group, *Verizon Communications* (November 17, 2003)

¹⁵ “Gross domestic product — the broadest gauge of activity within the USA — grew an annualized 7.2% in July, August and September, the biggest gain since 1984 . . .” *7.2% GDP Growth Fastest in 19 Years*, USA Today, October 10, 2003, available at http://www.usatoday.com/money/economy/gdp/2003-10-30-gdp_x.htm (December 9, 2003).

¹⁶ Richard E. Talbot and David M. Dixon, *Research Industry Comment. Integrated Telecommunication Services*, RBC CAPITAL MARKETS (June 26, 2003), p. 5

competitors to overbuild RBOC networks as it should have done to foster redundancy in the nation's telecom access network infrastructure, the FCC appears to have shifted the onus for capital investment onto the shoulders of the RBOCs as a competitive avoidance tool."¹⁷

FIGURE 1. CLEC LINES BY TYPE



Source: Data from Local Telephone Competition Status as of December 31, 2002, Industry Analysis and Technology Division, Wireline Competition Bureau, June 2003

14. The dividend policies of major telecommunications carriers also provide evidence of the perverse effect of mandatory network sharing. If UNE-P, which is rapidly rising, increased the incentive of carriers to invest, dividends paid by such firms would be constrained. That is, firms would tend to re-invest their earnings rather than paying them out to shareholders. Indeed, while dividends are looked at as income from the stockholder's perspective, they are a form of disinvestment by companies. This is why firms with high growth potential (i.e., opportunities to invest in profitable projects) tend to pay relatively smaller dividends than firms without such opportunities. Yet, with rapid UNE-P growth now evident in the marketplace, major telecommunications carriers are generally increasing dividends.¹⁸ This is true of both incumbent carriers and of the leading UNE-P provider, AT&T.

¹⁷ Jeffrey Halpern and Joshua W. Harrington, *U.S. Telecom: Go Long the Lawyers; In States' Hands, the New Regulations Will Take Years to Sort Out in the Courts*, BERNSTEIN RESEARCH CALL (August 22, 2003), p. 2.

¹⁸ This increase is not explained by the reduction in the tax rate for dividends, as analyzed in Jennifer L. Blouin, Jana Smith Raedy, and Douglas A. Shackelford, *Did Dividends Increase After the 2003 Reduction in Dividend Tax Rates?*, Working Paper (October 2003, <http://papers.ssrn.com/sol3/delivery.cfm/SSRN>

15. Currently, the average dividend yield for an S&P 500 company is 1.55%.¹⁹ SBC's dividend yield equals 4.83%, AT&T's 4.80%, Verizon's 4.70%, BellSouth's 3.88%.²⁰ All of these expected pay-outs are in the top ten percent of S&P 500 firms. It is not unusual for firms with slow, steady growth to pay high dividends. What makes these high pay-out levels distinctive is that they are generally increasing as revenue growth sharply declines or is negative. Moreover, all firms in the sector have been reducing debt loads to limit risk,²¹ giving firms additional reasons to limit dividends. But the current trend is in the opposite direction. For instance, the SBC dividend per share in the last quarter of 2000 was 25 cents; in the third quarter of 2003, it had increased to 28.25 cents; and SBC has recently announced the dividend per share was increasing again to 31.25 cents.²² AT&T, which slashed its dividend in 2000 in order to increase firm liquidity,²³ turned around in the fourth quarter of 2003 and hiked its dividend from 19 cents to 24 cents. This 26.3% increase came as revenues were falling precipitously.²⁴ The firm is simultaneously slashing capital expenditures, and forecasting healthy increases in UNE-P lines.²⁵ BellSouth recently increased its quarterly dividend to 23 cents from 19 cents.²⁶ (Verizon has deviated from the sectoral trend by keeping its dividend per share constant, allowing it (in part) to sustain capital expenditures relative to other ILECs.) These data

ID462542_code031111540.pdf?abstractid=462542. The study finds only "scant evidence that regular, quarterly dividends increased substantially in the first quarter following enactment. ." (Ibid., p. 23).

¹⁹ The dividend yield is calculated by dividing the expected annual dividend by the purchase price of an equity share. IndexArb, <http://www.indexarb.com/dividendYieldSortedsp.html>, (December 11, 2003). Omitting the 134 firms in the index which pay zero dividends, produces an average dividend yield of 2.12%.

²⁰ Ibid.

²¹ "The RBOCs have aggressively reduced financial risk during the last two years by predominantly using free cash flow and to a lesser extent the proceeds from asset sales to reduce debt." Moody's Investors Service, *The Far-Reaching Impact of UNE-P Regulation* (October 2003), p. 6. AT&T reduced net corporate debt "from \$56.2 billion entering 2001 to \$12.9 billion at year-end 2002." AT&T claims to have slashed capital spending by 50%, 1999 – 2002, "and we'll continue to moderate our spending going forward." AT&T Chairman's Letter, Annual Report (2002), <http://www.att.com/ar-2002/html/cl2.html>.

²² UPDATE – SBC Hikes Dividend, Sets Share Buyback, Reuters, December 12, 2003, available at http://biz.yahoo.com/rf/031212/telecoms_sbc_4.html, (December 15, 2003). During the first three quarters of 2003, SBC also declared three special dividends.

²³ Deborah Solomon and Nikhil Deogun, *AT&T May Cut Dividend as much as 77% -- Board to Debate Amount of First-Ever Reduction In Bid to Conserve Cash*, THE WALL STREET JOURNAL A3 (December 20 2000).

²⁴ AT&T reported annual telephone revenues of \$37.8 billion in 2002, down from \$46.9 billion in 2000. AT&T 2002 Annual Report, p. 12.

²⁵ "Our network investments are largely behind us. We spent \$3.9 billion in capital expenditures in 2002, roughly half the 1999 level, and we'll continue to moderate our spending going forward." AT&T Chairman's Letter, p.2, <http://www.att.com/ar-2002/html/cl1.html>. The same letter notes that AT&T's growth in UNE-P lines is strong. "Our initial results prove that customers want choice and will support a competitive offer. We have earned mid single-digit market share or higher in our first eight markets. We doubled our number of all-distance customers in 2002. In the fourth quarter alone, the number grew more than 25 percent from the previous quarter." Ibid., p. 3. "This pattern suggests strong opportunities for growth in new markets as well. We are confident that we will be offering all-distance service in a total of 14-17 markets by the end of 2003, with more markets to follow in 2004." Ibid., p. 4. In sum, the leading UNE-P retailer exhibits the belief that UNE-P lines are and will continue to grow at a brisk pace, and that capital expenditures on network infrastructure should be drastically reduced.

²⁶ Data from Bloomberg

are consistent with the observation that the best current financial strategy for existing telecommunications carriers is to reduce investment in risky network assets. Paying out dividends, as opposed to reinvesting these funds in new infrastructure, helps achieve this end.

16. As two recent reports explain, this disinvestment is directly traceable to current TELRIC UNE-P policies. Both the analysis by Moody's, the bond ratings agency, and Gartner, the NYSE-listed IT consulting firm, conclude that TELRIC-priced UNE-P is in large measure responsible for the decline in telecommunications investment incentives. Moody's states bluntly that "the FCC's recently released network unbundling order will have a negative credit impact on the industry's wireline operators."²⁷ It attributes the financial problems of the RBOCs to "economic recession," "technology substitution," and the fact that they "will continue to lose retail access lines due to the significant difference between UNE-P pricing and retail rates."²⁸ RBOCs will respond to the UNE-P threat by lowering retail rates and bundling, "which will likely require modest capital investment."²⁹ In addition, "RBOCs might elect to reduce both operating expenses and maintenance capex, the latter of which could result in network quality deterioration."³⁰

17. Gartner gives a similar appraisal of current regulatory policy:

By going beyond the intent of the [1996 Telecommunications] [A]ct, the FCC has stymied facilities-based competition and overall growth in the marketplace. Even though there were hundreds of negotiated contracts in place at the time, the FCC issued its Local Competition Order in August 1996. The FCC's rules pre-empted these contracts and negotiated rates by imposing requirements that the rate be based on TELRIC, a hypothetical costing methodology that had historically been used in [the] telephone industry to define rate structures and to define rate floors to prevent predatory pricing in a monopolistic marketplace. However, the FCC ordered this application to define UNE rate ceilings... The FCC's policies have and will continue to have a damaging effect on facilities-based competition and the overall health of the telephone economy.³¹

18. These analyses by independent analysts are consistent with the evidence of declining ILEC and CLEC investment we reviewed in our previous report, as well as with the pattern of CLEC entry found across states. The pattern conflicts with that predicted by the "stepping stone" theory used to justify aggressive network sharing policies. Recall that the regulatory justification of low wholesale prices in the UNE-P resale program is to encourage firms to enter the market and to then convert UNE-P lines into new networks. If the stepping stones were working, one should be able to use the number of UNE-P

²⁷ Moody's Investors Service, *The Far-Reaching Impact of UNE-P Regulation* (October 2003), p. 1.

²⁸ *Ibid*

²⁹ *Ibid*

³⁰ *Ibid*, p. 6.

³¹ Gartner, Inc., *Unbundled Network Element Policies Threaten U.S. Telecom Services Growth: Focus Report* (October 24, 2003), p. 5.

lines in a state in one period to help predict the number of facilities-based CLEC lines in that state in future periods.

19. We tested this theory in a multivariate regression equation estimated on semi-annual state-level data from the FCC's Local Competition Report, December 1999 through December 2002,³² and from the U.S. Department of Labor, Bureau of Labor Statistics.³³ See Appendix 1. The results demonstrate that the level of UNE-P lines (and other measures of non-CLEC owned competitive lines) have no statistically significant relationship with facilities-based CLEC lines (CLEC-owned or UNE-L) in future periods. This empirically contradicts the stepping-stone theory, the economic justification offered for TELRIC-priced UNE-P.

III. Phoenix Center Bulletin No. 6

20. In POLICY BULLETIN No. 5,³⁴ the Phoenix Center claimed to produce statistical evidence that ILEC investment is higher than it would otherwise be because of UNE-P.³⁵ We found their empirical results unconvincing, as detailed in our previous paper.³⁶ In POLICY BULLETIN No. 6,³⁷ the Phoenix Center concedes certain problems in their original estimation of the UNE-P/investment relationship, but claims that adjustments "recommended by Tom Hazlett, Art Havenner and Coleman Bazelon" help remedy them, producing estimates of the UNE-P/investment relationship that "are generally comparable to our earlier estimates, supporting the reasonableness of our chosen specification."³⁸ Hence, PHOENIX 6 endorses the PHOENIX 5 estimates as properly capturing the UNE-P/investment relationship.³⁹

21. Yet, far from correcting the fundamental flaws we identified in PHOENIX 5, PHOENIX 6 extends these analytical errors. First, the results produced by PHOENIX 5⁴⁰ are the product of spurious correlation,⁴¹ and no analysis presented in PHOENIX 6 adjusts for, or even recognizes, this demonstrable fact.⁴² The spurious nature of the estimated results is

³² Available at: <http://www.fcc.gov/wcb/iatd/comp.html>, November, 26, 2003.

³³ Available at: <http://data.bls.gov/labjava/outside.jsp?survey=la>, accessed November 26, 2003. The unemployment rate was included to control for differences in the economic climate between states and over time

³⁴ PHOENIX 5.

³⁵ PHOENIX 5, p. 1

³⁶ HHB, p. 13-15

³⁷ PHOENIX 6.

³⁸ PHOENIX 6, p. 11

³⁹ PHOENIX 6, p. 1.

⁴⁰ We focus on the results obtained from Model 2, the specification the Phoenix Center prefers.

⁴¹ If there is a plausible theory about the joint variation of two variables, the sign and size of the correlation coefficient may lend support to that theory. If no such theory exists, the correlation is classified as a spurious, or nonsense, correlation. See JACK JOHNSTON AND JOHN DI NARDO, *ECONOMETRIC METHODS* 9-10 (1997)

⁴² Comments submitted to the FCC by R. Carter Hill, at the request of Z-Tel Communications, Inc., purport to address this issue, but they do not. Rather than answering our charge of spurious correlation—that is, that the reported results are accidental—Hill discusses an issue we did not raise, Spurious Regressions—a situation where correlation is falsely found between data series that include trends. Reply

revealed in several ways. Estimating the PHOENIX 5 model using time-consistent data, for instance, eliminates the positive statistical relationship claimed to exist between UNE-P lines and ILEC investment. Only by mixing data sources (changing time periods) do the results claimed by Phoenix appear. The magnitude of the estimated UNE-P effect, which is implausibly large (the *one-year increase* in ILEC investment attributed to one new UNE-P line is estimated to exceed the entire *net capital stock* of an average ILEC line), also demonstrates the spurious nature of the Phoenix results. Moreover, as we previously showed, estimating the UNE-P effect using BOC-level (instead of state-level) data not only eliminates the relationship Phoenix claims between UNE-P and ILEC investment, but actually reverses it (as the estimated coefficient is both negative and statistically significant).⁴³ All of these ‘reality checks,’ as well as others reported in our previous Declaration, were ignored in PHOENIX 6. See Appendix 2.

22. The Phoenix results also fail to survive an additional cross-check. When the effect of Resale and UNE-L lines on ILEC investment are estimated using the method employed by Phoenix to evaluate the UNE-P effect, the results are strikingly different, and these distinctions are inconsistent with economic theory. Using the PHOENIX 5 model,⁴⁴ UNE-L lines reveal no statistically significant relationship with ILEC investment. Resale lines exhibit a relationship with ILEC investment that is statistically significant and *three times as large* as the estimated UNE-P effect, but in the *opposite* direction. See Appendix 2. While each of the three rival forms of competitive entry should theoretically have positive impact on ILEC investment under the “stepping stone” theory, the results sharply diverge: one is positive (UNE-P), one is negative (Resale), and one is indistinguishable from zero (UNE-L). The proper economic interpretation is not to pull the one desired “result” from this mixed bag, but to regard the “statistically significant” estimates as spurious

23. Second, PHOENIX 6 offers an economic theory to justify its regression model, an element lacking in PHOENIX 5. Unfortunately, the theory presented as justification for their econometric approach is entirely inappropriate. PHOENIX 6 offers an investment model developed in 1963 that has been abandoned by economists in recent decades due to its theoretical flaws and because it produces unreliable empirical results. More modern investment models take a different approach in estimating the relationship between explanatory variables (such as revenues or UNE-P lines) and investment flows. The theory invoked by Phoenix uses *changes* in explanatory variables, whereas more recent

Comments of R. Carter Hill, Ph D., *In the Matter of Joint Petition for Forbearance From Current Pricing Rules for the Unbundled Network Platform, Petition for Forbearance From Current Pricing Rules for the Unbundled Network Platform*, Federal Communications Commission, WC Docket No. 03-189, WC Docket No. 03-157 (September 22, 2003) [“Hill Declaration”] See Appendix 2 for further evaluation of the Hill Declaration.

⁴³ In a footnote, PHOENIX 6 claims that the use of BOC-level data is not superior to the use of state-level data, but this misses the point. The fact that these alternative specifications produce sharply inconsistent results demonstrates that neither result has compelling economic significance. Although PHOENIX 6 claims that it chose state-level data over BOC-level data because it produces a larger sample size, this does not explain how the BOC-level data produces inconsistent results. Hence, Phoenix simply ignores the issue of spurious correlation in its response.

⁴⁴ Specifically, Model 2, which PHOENIX 5 recommends as the preferred specification

investment theories use actual *levels*. Only by selectively utilizing the older method, and ignoring cross-checks for spurious correlation (see above), is Phoenix able to claim results showing a positive relationship between UNE-P lines and ILEC investment.⁴⁵ When the approach of more modern investment theories is used, the UNE-P/investment relationship found by Phoenix vanishes, as we demonstrated in our earlier Declaration and as explained in detail in Appendix 2.

24. Third, PHOENIX 6 misinterprets its own empirical estimates. The models estimated in PHOENIX 6 implicitly assume that the aggregate effect of UNE-P on investment is *zero*. Rather than acknowledge this, the paper reports only the positive relationship between UNE-P lines and ILEC investment in one year, omitting the corresponding negative effects in subsequent years. Given its inherent constraints, the model used by PHOENIX 6 is simply unable to offer empirical evidence as to the net relationship between the UNE-P lines and investment, and hence offers no support for the empirical findings in PHOENIX 5. This is also explained in more detail in Appendix 2.

25. Fourth, the econometric analysis used in PHOENIX 6, like the analysis used in PHOENIX 5, yields mistaken or misleading results. The spurious correlation noted above is not remedied in PHOENIX 6. For example, the PHOENIX 5 results are sensitive to the choice of sample period, and PHOENIX 6 uses the same arbitrary dataset. Further, the statistical tests the Phoenix Center cites to justify their investment modeling are not valid and the economist they turn to for authority misunderstands both the analysis performed by the Phoenix Center and our criticisms of it. These issues are also discussed in Appendix 2.

26. Finally, we note a critical misinterpretation in PHOENIX 6, namely that it has incorporated the criticisms we offered of PHOENIX 5, and has thereby created “a synthesis of the modeling preferences” of two alternative approaches. This mis-states the substance of our earlier Declaration. In that analysis, we demonstrated that the regression estimates produced in PHOENIX 5 disappear when the model they estimate is modified in reasonable ways. We never endorsed the empirical framework selected by the Phoenix Center, nor did we offer our “modeling preferences” to calibrate the UNE-P/investment relationship, as PHOENIX 6 suggests. Rather, we demonstrated the failure of PHOENIX 5 to produce plausible, consistent empirical estimates. “[T]he Phoenix results,” we wrote, “are contradicted by those produced by other equally (or more) appealing models evaluating the same or similar data.”⁴⁶ That continues to be the case, rendering the Phoenix estimates of the UNE-P/investment meaningless.

⁴⁵ This distinction between levels and differences is distinct from the familiar econometric issue of transforming an estimation equation, where levels are used in one specification and then differences in all variables are used in another. The issue here is that modern investment theory uses the level of revenues to explain the amount of investment. The Phoenix Center alternatively asserts that changes in revenues (and UNE-P lines) explain the amount of investment. In both cases, it is the amount of investment, and not its period to period change, that is being explained.

⁴⁶ HHB, at Par. 35–24. For example, our first alternative to PHOENIX 5’s Model 2 (in which we used BOC-level data instead of state-level data) estimated a negative, statistically significant relationship between UNE-P lines and ILEC investment. This showed that the asserted Phoenix Center finding of a positive, statistically significant relationship between UNE-P and ILEC investment was rejected by the data.

IV. The Consumer Federation of America Study

27. The Consumer Federation of America (CFA) recently issued a study of local telecommunications regulation entitled, "Competition at the Crossroads: Can Public Utility Commissions Save Local Phone Competition?"⁴⁷ The CFA makes two claims relevant here. First, that "[c]onsumer savings from local phone competition... [are] as much as \$5 billion a year,"⁴⁸ which the CFA attributes to the availability of UNEs at TELRIC prices. Second, that making UNEs available at current TELRIC prices does not reduce investment.

28. The CFA study estimate of consumer benefit from UNE-P competition is calculated by assuming savings of \$15⁴⁹ a month for 30 million households, 12 million of which have switched to CLECs and 18 million of which receive discounted service from ILECs. This results in annual consumer savings of \$5.4 billion (= 30 Million Households * \$15 per month * 12 months).

29. This simple estimate of consumer gains errs in focusing solely on nominal retail prices for some customers in one (the current) period. TELRIC rules have far-ranging, long-lived effects. In particular, such rules have a fundamental impact on investment in telecommunications infrastructure. A reduction in investment, which is now visibly occurring, depreciates the network and stymies the adoption of new technologies. This lowers quality of service over time, offsetting lower nominal prices. Such changes must be accounted for in estimating benefits to customers from TELRIC rates. The CFA, citing the spurious correlation between UNE-P and ILEC investment reported in PHOENIX 5 and PHOENIX 6 (see above), claims that TELRIC-priced UNEs increase network investment.⁵⁰ This leads the analysis proffered to erroneously exclude consideration of the actual relationship between mandatory network sharing rules and incentives to create network infrastructure.

30. The essential error thereby committed is illustrated in the following example. Current TELRIC prices offer CLECs wholesale discounts of, on average, about 53.5% from regulated retail rates.⁵¹ Suppose that this discount was, for the sake of argument,

given their basic approach. Importantly, we did not offer this adjusted model as a plausible explanation of the UNE-P/investment relationship. Nor did we present the estimates it generated as evidence that the actual relationship between UNE-P lines and ILEC investment was negative, despite the fact that elsewhere in the Declaration we presented evidence that does support this conclusion. We state this explicitly: "These [alternative] models do not, by themselves, prove a negative relationship between UNE-P and ILEC investment. Instead, they demonstrate that the data do not support the results asserted by the Phoenix study." HHB 2003, Appendix Par 9.

⁴⁷ Press Release, Consumer Federation of America, *Study Shows Incumbents' Arguments For Higher Wholesale Prices, Reduced Access to UNEs Don't Stand Up to Scrutiny*, <http://www.consumerfed.org/pr10.07.03.html> (October 7, 2003); full CFA study online at: http://www.consumerfed.org/unep_200310.pdf (October 7, 2003) ["CFA 2003"].

⁴⁸ Press Release, op cit

⁴⁹ The CFA provides no citations for the \$15 per month savings claimed.

⁵⁰ CFA 2003, p 24

⁵¹ UBS Warburg, *How Much Pain from UNE-P?* (August 20, 2002), Table 5.

increased to 100%, such that CLECs are permitted to use UNEs without charge. Predictably, lower UNE rates would induce additional UNE-P entry, and additional price discounts would be offered retail subscribers. The CFA calculation of “consumer savings” would rise:

- the number of discounted customers would increase;
- the size of the subscriber discount would rise

So gains would climb above the CFA’s \$5 billion annual estimate, except that at a zero wholesale price it is clear that investment in infrastructure would be stifled. Hence, capital would depreciate, and the quality of service would follow. Yet, there is no accounting for this loss in the CFA calculation, which therefore sheds no light on the key question: what is the balance between the gains associated with increased competitive pressure due to network sharing rules, and the losses associated with investment disincentives when property rights of investors are appropriated?

31. Another fundamental error in the CFA estimate of consumer savings is that it assumes that the only competitive pressure in local telecommunications derives from mandatory network sharing rules. This is unwarranted, in that wireless bundles (local/long distance) are already a key driver of discounted ILEC bundles,⁵² and given that head-to-head rivalry between ILECs and cable telephone operators is now available to about 15 million U.S. households.⁵³ Even more problematically, it assumes away any connection between TELRIC rules and incentives to create new networks. In that the goal of network sharing rules is to promote facilities-based competition, ignoring such rivalry eliminates consideration of the central policy question: how do unbundling policies help or hurt the emergence of new networks? The CFA approach produces estimates that (poorly) inform just one aspect (retail price reductions from competition among operators sharing the same facilities) of a range of economic trade-offs. Just as single-entry book-keeping is incomplete and misleading, the CFA estimates do not inform the policy debate.

V. The Hassett-Ivanova-Kotlikoff Paper

32. A September 2003 paper commissioned by AT&T is entitled “Increased Investment, Lower Prices – the Fruits of Past and Future Telecom Competition.”⁵⁴ In this study, Kevin Hassett, Zoya Ivanova, and Lawrence J. Kotlikoff (HIK) argue that TELRIC-based price controls increase investment in local telecommunications networks, and that setting TELRIC prices at still lower levels would increase network investments even more. The authors claim that existing empirical research, the textbook theory of monopoly pricing,

⁵² Federal Communications Commission, *Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, WT Docket No. 02-379 (July 14, 2003), at par. 104.

⁵³ KAGAN, *FUTURE OF CABLE TELEPHONY* 11 (2003)

⁵⁴ Kevin Hassett, Zoya Ivanova, and Lawrence J. Kotlikoff, *Increased Investment, Lower Prices – the Fruits of Past and Future Telecom Competition* (September 2003) [“HIK 2003”].

and a game theory simulation model that forecasts twenty years of TELRIC pricing all lend support to this conclusion. HIK are wrong on all three counts.

33. First, the evidence cited by HIK as support for the view that TELRIC-based rate regulation enhances investment focuses on telecommunications investment flows from 1996-2000, attributing the increase in aggregate (ILEC plus CLEC) investment during this period to network unbundling.⁵⁵ This omits many crucial facts, including the key observation that telecommunications investment began to plummet at the end of this period, just as the use of TELRIC-priced UNE-P began rapidly expanding. The observed correlation between UNE-P deployment and telecommunications investment, then, is *negative*.

34. Second, HIK purport to explain “What Textbook Analysis Tells Us About Telecom Investment.”⁵⁶ This discussion uses the standard analysis of monopoly pricing to assert that incumbent phone networks restrict output to raise prices and increase profits. HIK claim that TELRIC eliminates this incentive, resulting in expanded output and hence lower prices for consumers.⁵⁷ The analysis is factually incorrect, because – with or without TELRIC – retail rate regulation eliminates the incentive for incumbent carriers to restrict output. Incumbents do not set prices by searching for the profit-maximizing level of output; prices are set by regulation. HIK’s theoretical argument that TELRIC rates must increase output is false.⁵⁸

35. Third, HIK uses a game theory simulation to predict the effect that reducing current TELRIC prices would have on investment. This simulation assumes that, over the next 20 years, only two voice competitors will offer retail service to rival that provided by the

⁵⁵ HIK 2003, pp 5-8.

⁵⁶ HIK 2003, p. 11.

⁵⁷ “The unbundling requirements of TA96 enforce competitive pricing. While this lowers the prices the ILECs receive for their products, they are still likely to produce and invest more, either directly or through their sale of inputs to the CLECs, as they realize that limiting supply to increase prices will no longer work.” HIK 2003, p. 18

⁵⁸ The HIK paper shows this standard outcome via an equation, which defines marginal revenue – the increase in receipts a firm captures by selling an additional unit:

$$\frac{\Delta TR_g}{\Delta Q}(Q(K, L)) = p(Q) + \frac{\Delta P}{\Delta Q}(Q)Q(K, L)$$

This means that the additional revenue a firm obtains from selling an additional unit (left hand side) is composed of two terms (on the right hand side). the price obtained from that unit, which is always positive, and the reduction in price that accrues to other customers (not on the margin), which can be negative. HIK writes that economists who find that investment is reduced by generous unbundling rules (including low TELRIC prices), focus only on the positive revenue (first term) and ignore the second term. But the second term, the paper argues, “is of major import.” The authors believe that, without TELRIC the term is negative, but that the “TA96 eliminates this second term for the simple reason that prices are set by competition, rather than by the monopolist” (HIK 2003, p. 17) This is not true: the elimination of the second term was achieved via retail rate regulation decades ago. Rate regulated providers do not gain price increases by restricting units sold, prices are fixed by law. The second term in HIK’s Equation 2 is not negative in the absence of TELRIC, but zero.

incumbent carrier, and will both do so by sharing the incumbent's network. HIK ignores the fact that significant facilities-based competition is already provided by cable telephony⁵⁹ and wireless, and that the object of network sharing rules is to promote further development of such alternative networks. This renders the exercise conducted moot, because the impact of unbundling rules on such new rivalry is not considered. Rather, it is ruled out by assumption.⁶⁰

36. Finally, HIK claim that investment increases by \$155 billion over twenty years if TELRIC prices are lowered to what HIK claim to be the proper level.⁶¹ The estimate is meaningless, because it is derived by categorizing all "costs," including operating costs, as "investments."⁶² Hence, the actual result of the model is that *costs* increase. HIK simply elects to classify "costs" as "investment," but this has no economic significance. All else equal, higher costs imply less efficiency, not greater output, investment, or innovation. All else equal, consumers benefit when costs decline, not when they rise.

This concludes our Declaration.

⁵⁹ Cable telephony already serves 3 million consumers and is available to 15 million households. *Local Telephone Competition. Status as of December 31, 2002*, Federal Communications Commission, Wireline Competition Bureau (June 2003). Industry analysts estimate that rival cable networks will deliver residential telephone service to over 20 million U.S. homes by 2013, half way through a twenty-year scenario beginning today. KAGAN, *FUTURE OF CABLE TELEPHONY* 29 (2003).

⁶⁰ Indeed, the assumption that the TELRIC regime will last at least through the year 2023, and that no rival last mile networks will be created during this period, is fundamentally inconsistent with the paper's conclusion that perpetuation of this regime will promote investment in competing telecommunications networks.

⁶¹ HIK calculate what they deem to be true TELRIC rates using the FCC's 1998 Synthesis Model deflated by 5 percent annually for five years (HIK 2003, Executive Summary p. 5). This calculation omits, in particular, compensation to investors for sinking irreversible capital in a declining cost industry, as well as compensation for option values. See the Declaration of Robert Pindyck, submitted to the Federal Communications Commission in this proceeding (December 16, 2003). Further, the authors erroneously claim that TELRIC rates are defined by statute (HIK 2003, p. 14).

⁶² We do not mean to imply that the estimate would be accurate if investment were properly defined, as the 20-year game theory simulation used to produce this estimate is unconvincing in multiple dimensions.

APPENDIX 1

TESTING THE “STEPPING STONE” THEORY

1. The rationale underlying unbundling rules is that entrants enjoy economies of scale and scope if they can access the existing network (owned by an incumbent telecommunications carrier) at cost-based prices; and that such regulatory assistance for entrants will soon result in new physical networks as entrants transition from the shared use of network elements to building and utilizing their own facilities. “Competitors argue that they are making substantial investments in their own facilities and are using UNEs as a stepping stone to their own facilities.”¹ The implication is that, where regulated access to networks is relatively widespread, the emergence of facilities-based competition will follow.

2. To test this theory, we estimated the following equation on state-level data:

$$COL_{i,t} = C + \beta_1 Z_{i,t} + \beta_2 UL_{i,t-1} + \beta_3 UL_{i,t-2} + e_{i,t} \quad (\text{Eq. A1})$$

where,

$COL_{i,t}$ = CLEC-owned lines in state i during semi-annual period t , divided by BOC lines in state i during period t ;

C = constant term, divided by BOC lines;

$Z_{i,t}$ = unemployment rate in state i during semi-annual period t , divided by BOC lines in state i during period t ;

$UL_{i,t-1}$ = UNE-P lines in state i during semi-annual period $t-1$, divided by BOC lines in state i during period t ;

$UL_{i,t-2}$ = UNE-P lines in state i during semi-annual period $t-2$, divided by BOC lines in state i during period t ;

$e_{i,t}$ = error for estimate of state i during period t .

3. The “stepping stone” theory suggests that the number of UNE-P lines in a state in one period should help to predict the number of CLEC-owned competitive lines in future periods. Hence, lagged values of UNE-P lines are included as regressors. We also include the state unemployment rate as an independent variable on the theory that it is a proxy for financial conditions in the respective states, and these financial conditions help explain CLEC entry decisions. The co-efficients of interest are associated with the lagged terms (the number of UNE-P lines in a state one or two periods previous) which, under the stepping stone theory, should help to predict CLEC-owned lines. This would be evidenced by a positive effect as estimated by the coefficients, β_2 and β_3 .

4. The coefficient estimates on the UL variables in the estimated regression model A1 were insignificant, but the regression errors exhibited serial correlation. We corrected for

¹ Gregory L. Rosston and Roger G. Noll, *The Economics of the Supreme Court's Decision on Forward Looking Costs*, 1 REVIEW OF NETWORK ECONOMICS (September 2002): 81-89, p. 88.

this with an AR(2) process.² Estimating the autoregression-corrected model, no statistically significant relationship was found between UNE-P lines in one period and CLEC-owned lines one or two periods later. See Table A1. The coefficients β_2 and β_3 on lagged UNE-P lines are not significantly different from zero, as indicated by P-Values substantially greater than 0.05.³ We also tested the theory using UNE-L lines and Resale lines in place of UNE-P lines, and with longer lags. Finally, we used UNE-L as the dependent variable in place of CLEC-owned lines (with UNE-P lines as the explanatory variable). Results did not meaningfully change across specifications. The stepping stone theory is rejected by the evidence.

Table A1: Test of the Stepping-Stone Theory

Dependent Variable: CLEC-owned Lines		
	Coefficient	P-Value
Constant	314347	0.0022
β_1 (unemployment)	-9294	0.0409
β_2 (UNE-P lines lagged one period)	-0.049	0.4908
β_3 (UNE-P lines lagged two periods)	0.02	0.7565
AR(1)	1.35	0
AR(2)	-0.371	0.0013
Adjusted R-squared	.92	
F-statistic	176.9	

² Autoregressive error corrections are standard procedures in econometrics for correcting persistence in the regression equation disturbances. Although the equation misses are zero on average, there can be some carryover in the equation disturbance from one period to the next, here from one half year to the next. In this case, the second order autoregressive process uses information from the previous two periods -- up to a year prior -- to improve the accuracy of the regression coefficients and associated statistical tests.

³ A P-Value of 0.05 or less indicates that the observed value (in this case the coefficient estimate on lagged values of UNE-P lines) will be observed less than 5% of the time by chance alone if the real value is zero. The reported P-Values of 0.49 and 0.76 are far greater than the 5% bound typically used, and even the 10% bound occasionally used.

APPENDIX 2

EVALUATING THE ANALYSIS IN PHOENIX CENTER POLICY BULLETIN No. 5 AND IN PHOENIX CENTER POLICY BULLETIN No. 6

1. In our previous Declaration, we critiqued empirical estimates of the relationship between UNE-P lines and ILEC investment offered in a paper published by the Phoenix Center.¹ Phoenix presented regression results from a model that predicted the local network investment by a BOC in a particular state in a particular year by using a constant term and three explanatory variables: the contemporaneous revenue of the BOC within the state, the contemporaneous number of UNE-P lines within the state, and a dummy variable (equal to 0 in 2001, 1 in 2002). The data spanned two years (2001, 2002), included 28 states, and were defined as first differences (*e.g.*, the increase in revenue in 2002 over 2001). In Model 2, Phoenix's preferred regression, the dependent variable (ILEC investment) and two of the explanatory variables (UNE-P lines and ILEC revenue) are divided by the number of ILEC lines within the state. The model predicts that, without accounting for UNE-P line growth in 2002, the total capital stock of the ILECs would have declined by 13%. Actual capital stock, however, declined just 7%; the difference is attributed to the growth in UNE-P lines. The additional ILEC investment associated with each additional UNE-P line amounts to \$759.

2. We demonstrated these results to be spurious.² This was shown by producing three alternative models that evaluate the Phoenix data in equally (or more) compelling ways, and testing whether the results from Model 2 hold up. They do not. This demonstrates that the model is not reliable in analyzing the impact of UNE-P on investment incentives, an outcome that likely stems, at least in part, from the fact that Model 2 includes no time element, an essential aspect in any consideration of investment. In that model, the change in investment caused by an explanatory variable (such as UNE-P line growth) is assumed to take place almost instantly (within the same year). In reality, investments in telecommunications networks are long-lived, and phone carriers tend to stretch out investment plans across several years. Associating all current changes in an explanatory variable (like UNE-P line growth) with all current changes in the dependent variable (ILEC investment) imposes a highly unrealistic economic relationship. Statistical estimation of the relationship between two variables (like UNE-P line growth and ILEC investment growth) that is unsupported by economic theory produces meaningless, and often misleading, results.

3. The Phoenix Center responded to our paper in their POLICY BULLETIN No. 6 (PHOENIX 6). PHOENIX 6, ignoring much of our analysis,³ focuses on the criticism that

¹ HHB 2003, pp. 13-15; PHOENIX CENTER POLICY BULLETIN No. 5, pp. 10-14 ["PHOENIX 5"].

² HHB 2003, p 15.

³ For instance, it side-steps our first alternative model, which finds that when the investment data are evaluated at BOC-level rather than state-level, the relationship between UNE-P and ILEC investment is negative and statistically significant. PHOENIX 6 dismisses this finding "We do not, as suggested by HHB, unnecessarily reduce variation and sample size by aggregating data up to the Bell Company level." PHOENIX 6, p 5. This misconstrues our paper. The information provided by this alternative specification

their model included only static relationships between variables. The paper then argues that, when lagged terms are added (such as investment in the previous period), changes that happen over time are properly accounted for. In support of this approach, the paper cites a 1963 paper by economist Dale Jorgenson.⁴ PHOENIX 6 claims that their new models that adopt this approach yield the same conclusion about the relationship between UNE-P and investment as their previous model that excluded any consideration of time. The paper argues that these findings support the empirical estimates in PHOENIX 5's Model 2, which purports to provide evidence that the growth in UNE-P lines leads to greater investment in telecommunications infrastructure. PHOENIX 6 concludes, "In sum, we find no evidence of 'weakness' in the results; the results are, in fact, extremely robust....[W]e find no reason to question the empirical results from POLICY BULLETIN No. 5."⁵

4. This conclusion is unwarranted. PHOENIX 6 offers an investment model that is untenable, and produces results that do *not* quantify the relationship between UNE-P lines and ILEC investment. Only by misinterpreting those results is PHOENIX 6 able to claim that they support the estimates of PHOENIX 5's Model 2. Before deconstructing the PHOENIX 6 models, however, we first discuss the interesting fact that the paper left many of our criticisms of PHOENIX 5 unchallenged. In particular, it did not answer our conclusion that empirical results were the product of spurious correlation. This can be shown in multiple ways, each of which undermines the PHOENIX 6 conclusion that there is "no reason to question the empirical results from Policy Bulletin No. 5."⁶

A. Phoenix Center Estimates are the Product of Spurious Correlation

June versus December UNE-P data

5. PHOENIX 5 uses investment and revenue data measured as of December of each year, while UNE-P lines and total access lines are measured as of June.⁷ No justification is offered for this mismatch. Data availability was not a constraint: the FCC reports the number of UNE-P lines nationally for two time periods, June and December. The total number of access lines is also available in either June or December. For the paper's preferred regressions, in which some variables are divided by BOC lines, the mismatch (using December investment and revenue data with June total access lines) is unsupported. And the choice of time periods is critical to the results claimed.

provides an important cross-check. If state-level data produce a definitive answer, why do BOC-level data produce the opposite? Reduced variation or sample size does *not* provide an answer, and the assumption in the Phoenix Center's papers of independence over state COSA's served by the same BOC is unlikely to be even marginally realistic in any case. Lacking a theory to sort between the approaches, the most reasonable conclusion is that the results produced by either method are unreliable. That is our conclusion. PHOENIX 6 chooses to simply ignore important evidence, arbitrarily selecting one set of results and rejecting the other.

⁴ Dale W. Jorgenson, *Capital Theory and Investment Behavior*, 53 AMERICAN ECONOMIC REVIEW (May 1963): 247-259.

⁵ PHOENIX 6, p 11.

⁶ PHOENIX 6, p.11.

⁷ This approach carries over to PHOENIX 6, as well.

6. Given investment (I) and revenue (R) data from December and the choice of UNE-P and total access lines (Lines) from either June or December, the Phoenix Center chose to use UNE-P lines from June and divide all three variables by Total Access Lines from June. But only when June UNE-P lines are paired with December investment do the results show statistical significance for the relationship between UNE-P lines and ILEC investment.⁸ See Table A2. The Phoenix Center results are not robust; results critically depend on arbitrary mixing and matching of data.

TABLE A2 VARYING PHOENIX RESULTS WITH JUNE VS. DEC. DATA (PHOENIX 5 MODEL 2)				
	December Investment and Revenue Data			
	June Total BOC Access Lines		December Total BOC Access Lines	
	June UNE-P Lines	December UNE-P Lines	June UNE-P Lines	December UNE-P Lines
Constant	13.34 (1.21)	18.12 (1.57)	13.43 (1.17)	18.80 (1.55)
Δ Revenue	0.42 (1.49)	0.30 (1.03)	0.45 (1.57)	0.32 (1.07)
Δ UNE-P	759.1 (2.55)*	450.23 (1.54)	795.6 (2.54)*	454.69 (1.47)
Dummy	-70.94 (-4.46)*	-79.36 (-4.74)*	-72.27 (-4.34)*	-81.15 (-4.64)*
Adj-R-Sqr	0.44	0.40	0.44	0.39
No. of Obs.	52	52	52	52

* Statistically significant at the 95% confidence level.

7. To be clear, and to avoid the confusion in PHOENIX 6, we are not arguing for one dataset over another. Investment lags stretch out *far beyond* intervals of a few months. Neither June nor December data reasonably approximate the long-lived capital structure decisions being made. The evidence here, though, rejects the simple approach taken by the Phoenix Center, demonstrating the unreliability of its empirical estimates.

Magnitude of the estimated effect

8. PHOENIX 6 endorses PHOENIX 5's empirical estimate that each additional UNE-P line spurs the competing ILEC to immediately invest an additional \$759. We noted in our earlier critique that this magnitude is implausible, given that the entire net capital stock of

⁸ Despite the PHOENIX 5 claim (p. 10) that 52 observations are "...more than adequate for econometric analysis and traditional hypothesis testing," the Hill Declaration (p. 7) says that "[e]stimating this dynamic relationship is a challenge given such a short time-series of data ..." A further drawback to using June data is that using December data would have allowed the use of an additional year of data because the FCC began reporting UNE-P lines in December of 1999.

the BOC's local exchanges is currently about \$106 billion, or approximately \$681 per line.⁹ According to the Phoenix study, each UNE-P line results in additional BOC investment that exceeds the existing average BOC net capital per line,¹⁰ which, of course, was built up over many years. In 2002, the BOC's capital expenditures (gross investment) were about \$123 per BOC line.¹¹ Consequently, the Phoenix study asserts that a BOC would spend more than six times its annual average expenditure per line for each line it loses to UNE-P.

Contradictory Results for Resale, UNE-L, and UNE-P lines

9. PHOENIX 5 reports that the positive relationship between ILEC investment and UNE-P lines contrasts with the lack of any relationship observed between ILEC investment and Resale lines or between ILEC investment and UNE-L lines.¹² These findings are contradictory in the context of the regulatory justification for UNE-P: "Competitors argue that they are making substantial investments in their own facilities and are using UNEs as a stepping stone to their own facilities."¹³ It is the anticipation that UNE-P lines will spur actual (competitive) networks that allegedly drives incumbents to invest more. But this is precisely the argument for Resale as well as for new lines utilizing local loop unbundling (UNE-L). The economic theory that is purportedly tested in PHOENIX 5 is at least as well tested by examining market responses to Resale and UNE-L lines. That these variables are not positively related to RBOC investment implies that the distinct result found for UNE-P does not capture the asserted economic relationship.

10. To further explore this issue, we replicated Model 2 from PHOENIX 5 using alternative measures of competitive entry via use of the ILECs infrastructure: UNE-P lines, UNE-L lines, and Total Service Resale (TSR) lines. We also estimated the equations using the four permutations of December and June data described above.

⁹ We estimate \$106 billion by summing the SBC, BellSouth, and Verizon net capital stock data from ARMIS for 2002 and adding 15%. (We add 15% because that was Qwest's average for the previous three years. We are unable to use Qwest's data from ARMIS for 2002 because it was not reported until just prior to the filing of this Declaration.) The FCC reports 179 million total lines in 2002. *Local Telephone Competition: Status as of December 31, 2002*, Federal Communications Commission, Wireline Competition Bureau (June 2003). At the end of 2001, the BOCs served 86.97% of all loops. *Trends in Telephone Service*, Federal Communications Commission, Wireline Competition Bureau (August 2003). Assuming the same percentage in 2002, BOCs would have served 155.7 million lines. \$106 billion/155.7 million = \$681 per line.

¹⁰ In fact, the Phoenix results suggest that if all BOC lines were converted to UNE-P, the net capital stock of the BOCs would more than double.

¹¹ Skyline Marketing reports 2002 BOC capex as \$19.2 billion. Skyline Marketing Group, *CapEx Report: 2002 Annual Report* (2002), p. 17. 2002 BOC lines are estimated at 155.7 million (see footnote 9 above). \$19.2 billion/155.7 million = \$123 per line.

¹² PHOENIX 5, p. 4.

¹³ Gregory L. Rosston and Roger G. Noll, *The Economics of the Supreme Court's Decision on Forward Looking Costs*, 1 REVIEW OF NETWORK ECONOMICS (September 2002), 81-89, p. 88.

TABLE A3. PHOENIX MODEL 2 RESULTS BY CLEC CATEGORY
(COEFFICIENT ON COMPETITIVE LINES, T-STATISTICS IN PARENTHESES)

	December Investment and Revenue Data			
	June BOC Access Lines		December BOC Access Lines	
	June UNE-P Lines	December UNE-P Lines	June UNE-P Lines	December UNE-P Lines
UNE-P	759.1 (2.55)*	450.2 (1.54)	795.6 (2.54)*	454.7 (1.47)
UNE-L	977.1 (1.09)	195.7 (0.21)	1,057.9 (1.14)	237.8 (0.24)
TSR	-2,659.1 (-2.38)*	-1,033.3 (-1.02)	-2,756.7 (-2.37)*	-1,024.4 (-0.97)

* Statistically significant at the 95% confidence level.

11. On economic grounds, UNE-P effects should be similar to those observed for UNE-L or Resale. The estimated effects, however, are strikingly different. When the effects are estimated in exactly the same model used to estimate the effect of UNE-P line growth, UNE-L line growth has no statistically significant effect, and TSR has a statistically significant, large and *negative* effect on investment. The estimate produced in the Phoenix equation suggests that for each additional TSR line, ILEC investment declines by \$2,659 – a magnitude that is more than three times the size of the estimated UNE-P effect and in the *opposite* direction. Again, to be clear, we do not accept this as reliable evidence that the requirements that ILECs resell their retail services tends to lower ILEC investment. Rather, we take this estimate to be implausibly large, and to be derived from a dubious model of investment. The results do shed important light on one question, however, and that is the reliability of the Phoenix models. Their estimates of economic relationships which should be similar are found to be highly contradictory.

B. PHOENIX 6 Relies on an Untenable Economic Model of Investment

12 We agree with the Phoenix Center's statement that econometric models must be based on sound economic theory.¹⁴ Statistical and econometric tests, such as those performed by the Phoenix Center, are conditional on the presumption that the underlying economic model is a correct reflection of actual economic relationships.

13. Importantly, not all economic questions are illuminated by empirical estimates produced in multivariate regressions. Where models are not theoretically sound, or the data available for evaluation are inadequate, empirical results will not be informative and can actually be misleading.

¹⁴ "In specifying our empirical models, the primary objective is consistency with economic and econometric theory .." PHOENIX 6, p 3.

14. The UNE-P/investment relationship is difficult to estimate in the framework used by Phoenix, for reasons involving both theory and data availability. First, investment flows are quite difficult to predict in statistical models.¹⁵ Investors rationally anticipate long-run conditions impacting markets, whereas the observed data are measured only in the past. What typically matters to financial investors is what conditions look like five or ten years down the road, whereas the independent variables used to predict investment flows (such as Revenue or UNE-P lines) are observed only up to the present. This implies that the key explanatory variables are *unobserved*, which immediately leads to a second critical problem: the use of short-term data to predict long-run effects.¹⁶ In the Phoenix models, data changes for two years (2001, 2002) are used to estimate changes in capital anticipated to last five or ten times that long. This forecasts a long trajectory based on just the very beginning of the path, a treacherous exercise even under favorable circumstances. Here, the circumstances are highly unfavorable due to a third major problem: the two-year sample period is marked by an increase in capital stock (2001) followed by a decrease in capital stock (2002). This dramatically complicates the investment analysis, because investing and disinvesting are well known to be asymmetric: firms typically expand (while investing) at a different pace than they contract (while disinvesting). This stems from the constraints imposed by capital fixity, depreciation rates, and market cycles. This is a critical problem in the Phoenix analysis because the positive relationship between UNE-P and investment is actually the result of an over-prediction of the 2002 decline in capital stock (it is predicted to decline 13 percent, but falls “only” 7 percent), which the model associates with the uptick in 2002 UNE-P lines. Since the decline in investment predicted by Phoenix is materially impacted by the fact that firms disinvest differently than they invest, ascribing the positive “surprise” in 2002 capital stock to UNE-P (as the Phoenix analysis does) is unwarranted.

15. We pointed out that one major flaw in PHOENIX 5 was the assumption that firms immediately adjusted to the desired, or optimal, capital stock. This conflicts with *any* theory of investment, all of which postulate that investments are undertaken over time. PHOENIX 6 sought to rectify that particular problem by adding variables to its estimated equation, including lagged values for ILEC capital stock and investment. Unfortunately, this modification does not produce a sensible economic model, and the results reported by PHOENIX 6 – even when properly interpreted (see discussion below) – are not reliable.

¹⁵ Robert S. Chirinko, *Business Fixed Investment Spending: Modeling Strategies, Empirical Results, and Policy Implications*, 31 JOURNAL OF ECONOMIC LITERATURE (December 1993): 1875-1911.

¹⁶ The fact that the important variables are virtually all unobserved leads institutions and investors that must invest billions of dollars in actual capital markets to rely not on the regression models of the sort utilized by the Phoenix Center but on the range of expert analysis offered by investment analysts and consulting firms specializing in the interpretation of future trends in telecommunications markets. These analysts have reached broad consensus that the relationship between UNE-P and investment (both ILEC and CLEC) is *strongly negative*. Moody's Investors Service, *The Far-Reaching Impact of UNE-P Regulation* (October 2003), Gartner, Inc., *Unbundled Network Element Policies Threaten U.S. Telecom Growth Focus Report* (October 24, 2003), Bernstein Research, *RBOCs: Upgrading BellSouth on Valuation, FCC's Rulemaking a Mixed Bag – Group Valuations and Yields Compelling But with Few Catalysts* (February 21, 2003), Fulcrum Global Partners, *Wireline Communications: Thoughts on FCC Order* (February 25, 2003), Guzman & Company, *Bells' Big Defeat at the FCC Will Be Taken to Court; Reiterate Perform in Line Rating on Verizon* (February 21, 2003).

16. PHOENIX 6 claims that the motivation for the modeling approach taken is provided by the "neoclassical" investment model developed by Dale Jorgenson in 1963.¹⁷ In the past 40 years, however, investment theory has changed markedly.¹⁸ The older models cited by the Phoenix Center explain investment as a function of *changes* in key variables whereas more recent models explain investment as a function of the *levels* of key variables. Only when the Phoenix variables are specified as differences can a positive statistical relationship between UNE-P lines and ILEC investment be observed; levels yield no relationship. Using the older models is crucial to the policy conclusion reached.

17. The fact that the results obtained from the rival specifications differ is troubling, because it forces an examination of why that should be the case. Specifically, it causes one to appraise the reliability of the neoclassical investment models, which have been found to perform poorly in producing empirical estimates. Economists have widely regarded them as being highly sensitive to the particular assumptions underlying the estimated equation. One economist noted that, "This sensitivity is highlighted by the diversity of results from papers presented at a Brookings Conference" reported in 1971. Using the neoclassical investment model, the papers reported a range of estimates of the effect on investment from a tax depreciation change stretching from 1.46% to 6.89%.¹⁹ Another prominent economist, commenting on the early neoclassical investment approach, has written that "we need to modify the model if we are to obtain even a remotely reasonable picture of actual investment decisions."²⁰

18. Newer models have displaced the older models of investment cited by Phoenix.²¹ These models are far from perfect, but they are considered an advance by most economists working in this field. The more recent models do not use differences for right-hand side variables; the post-neoclassical parallel to the Phoenix models uses levels of right-hand side variables.

19. The reason for this distinction is found in how the rival models address the issue of adjustment costs. When the term "adjustment costs" is used in the investment literature, it

¹⁷ No investment theory was cited in PHOENIX 5, and the models specified there differ from the approach taken by Jorgenson in 1963. PHOENIX 6 claims, however, that similar models (that include lagged values and capital costs) support the results in PHOENIX 5. This conclusion is incorrect, as shown below.

¹⁸ See, for example, Charles W. Bischoff, *The Effect of Alternative Lag Distributions*, in Gary Fromm, ed., *TAX INCENTIVES AND CAPITAL SPENDING*, Brookings Institution, Washington, D C, 1971, pp. 61-130. Robert Eisner and Robert H. Strotz, *Determinants of Business Investment*, in *IMPACTS OF MONETARY POLICY*, Commission on Money and Credit, Prentice-Hall, 1963, pp. 59-233. Robert E. Lucas, Jr., *Adjustment Costs and the Theory of Supply*, 75 *THE JOURNAL OF POLITICAL ECONOMY* (August 1967): 321-334. Michael Mussa, *External and Internal Adjustment Costs and the Theory of Aggregate and Firm Investment*, 44 *ECONOMICA* (May 1977): 163-178. James Tobin, *A General Equilibrium Approach to Monetary Theory*, 1 *JOURNAL OF MONEY, CREDIT AND BANKING* (February 1969): 15-29. James Tobin, *Monetary Policies and the Economy. The Transmission Mechanism*, 44 *SOUTHERN ECONOMIC JOURNAL* (January 1978): 421-431.

¹⁹ Robert S. Chirinko, *Business Fixed Investment Spending: Modeling Strategies, Empirical Results, and Policy Implications*, 31 *JOURNAL OF ECONOMIC LITERATURE* (December 1993): 1875-1911.

²⁰ DAVID ROMER, *ADVANCED MACROECONOMICS* 348 (1996).

²¹ See the references in footnote 18 among many others.

refers to how the desired capital stock is achieved by the firm. Post-neoclassical investment models recognize that it is costly (and risky) for firms to adjust their capital stock. Firms hedge capital expansion plans, knowing that circumstances could change before they complete an irreversible commitment. In these adjustment cost models, a firm's response to a change in economic circumstances (say, an increase in UNE-P lines) is built into investment decisions, as the firm recognizes that reconfiguring the capital stock is costly. Take, for example, a telephone carrier that, due to changed circumstances, wishes to convert all its copper facilities to fiber optics. If there were no additional costs associated with doing it all at once the firm would convert instantly, but adjustment costs are substantial. Economists categorize adjustment costs as internal (*e.g.*, disruption as capital is changed) or external (*e.g.*, increased capital equipment costs as multiple firms attempt to simultaneously purchase capital equipment).²² The optimal investment path reflects these costs and typically takes several years to reach the desired goal. This time dimension is an important component of post-neoclassical investment theory. The investment path is formally brought into the model. The models cited by the Phoenix Center simply ignore adjustment costs.

20. Such models assume that the firm either instantly adjusts its stock of capital equipment to a changed circumstance (as in the PHOENIX 5 models), or else adjusts a fraction of the way in each period but ultimately completes build-out to each "optimal" capital stock implied by market conditions at one time (even when, years later, it is no longer the desired capital stock). Thus, where revenue²³ increases in Year 1, then decreases in Year 2, and then increases in Year 3, these models assume that the firm first initiates plans for construction of a larger capital stock, then initiates plans for a smaller capital stock in the following year, and then begins building a larger capital stock in Year 3 – by which point all three investment (or disinvestment) projects exist simultaneously. The firm is assumed to relentlessly pursue all prior investment plans, regardless of how market conditions change. This is the theoretical approach that, while superseded in the economic literature, the Phoenix Center has chosen as justification for its estimating equation.²⁴

21. The key assumption that differs from modern investment models is that all planned investment is ultimately built, an assumption that offends common sense and has been empirically discredited. This assumption, however, allows PHOENIX 6 to estimate an equation that depends on the differences in, rather than levels of, the determinants of the desired capital stock to explain the level of investment. The reason is that under the Phoenix Center assumptions, when a firm makes an adjustment toward a new desired capital stock (an investment) it is comparing the new desired capital stock to the previous period's *desired* capital stock, *even though that capital stock is not yet and may never be*

²² See Michael Mussa, *op cit* for the classic presentation, or, for more recent work, Austan Goolsbee, *Investment Tax Incentives, Prices, and the Supply of Capital Goods*, 113 QUARTERLY JOURNAL OF ECONOMICS (February 1998) 121-148.

²³ Recall that Revenue is the key variable used in the Phoenix regressions to predict the optimal capital stock

²⁴ PHOENIX 5, pp. 10-14

*actually built.*²⁵ The Phoenix Center can then specify investment as this period's desired capital stock minus last period's desired capital stock. Since the desired capital stock is a function of the level of the explanatory variables (BOC Revenue, UNE-P lines, *etc.*), the estimation equation for investment uses this period's level minus last period's level, or simply the time-differences in the values of the explanatory variables.

22 Adjustment cost models do not assume that every desire is ultimately built (or unbuilt), and so they cannot be estimated in difference form. Instead of specifying investment as this period's desired capital stock less last period's desired capital stock, these models specify investment as this period's desired capital stock minus last period's *actual* capital stock. Consequently, the explanatory variables only enter the estimation equation as levels, not differences. The Phoenix Center results, dependent on the model using right-hand-side differences, rest on the unrealistic assumption of complete build-out, an approach rejected by modern investment theory.

23. The full build-out assumption is even more restrictive than it appears, however, because (as we explain in the following sub-section) the equations estimated in PHOENIX 6 do not – when properly interpreted – produce empirical support for PHOENIX 5. This leaves the empirical results in PHOENIX 5 standing alone, and these results depend on *instantaneous* full build-out, an assumption that even PHOENIX 6 repudiates.

C. PHOENIX 6 Critically Misinterprets Its Empirical Estimates

24 PHOENIX 6 purports to estimate the effect of UNE-P on ILEC investment, and, in finding statistical evidence of a positive relationship, to support the estimates produced by PHOENIX 5. The analysis is incorrect. In fact, the models estimated by PHOENIX 6 incorporate the assumption that *UNE-P's total effect on investment is zero*. The estimated coefficients reported by the Phoenix Center imply a one period investment response that is entirely offset by future *disinvestment*. This is a product of the model employed by PHOENIX 6. As such, the regressions estimated do not address, much less answer, the question posed regarding the net relationship between UNE-P and ILEC investment.

25. The models in PHOENIX 6 add lagged capital to the PHOENIX 5, Model 2 specification, but retain the use of changes (rather than levels) in the other explanatory variables. In comparing the results of their new Model 2 with Model 2 of PHOENIX 5, PHOENIX 6 notes, “the coefficient on ΔU is barely affected (\$757.50 versus \$759.00).”²⁶ PHOENIX 6 considers the coefficient estimate on the ΔU variable to be comparable across the two specifications. It is not.

²⁵ The neoclassical model forms the desired capital stock based on each period's data, without smoothing over multiple periods, so the rapidly changing desired capital stocks underlying the Phoenix Center models are never actually built.

²⁶ PHOENIX 6, p. 9.

26. The estimated \$757.50 per UNE-P line investment increase reported in PHOENIX 6 is only the first year's estimated impact. As described in more detail elsewhere,²⁷ the total effect of what economists call the "multiplier" (in this instance, the relationship between UNE-P lines and capital investment) is zero by construction in the dynamic models estimated in PHOENIX 6. (Because PHOENIX 5 did not specify any time element, there are no effects beyond the first period.) Properly interpreted, the comparison of the two Policy Bulletins' estimates of the effect of an additional UNE-P line on ILEC investment would be \$759.00 from PHOENIX 5 versus \$0 from the dynamic models in PHOENIX 6—not the robust result asserted.

27. Why are the estimates of the UNE-P effects on capital in PHOENIX 6 necessarily zero? Because the Phoenix Center models use changes in UNE-P lines to explain the amount of investment. The change in UNE-P lines is the level of UNE-P lines in one period minus the level of UNE-P lines in the previous period. Using "U" for "UNE-P lines," we have: $\Delta U = U_t - U_{t-1}$. (For instance, if $U_t = 153$ and $U_{t-1} = 139$, then $\Delta U = 14$.) By substituting the level this period minus the level in the previous period for the change in UNE-P lines, it becomes clear that the larger base this year that causes the increase becomes a negative next year that offsets any benefit caused by that increase in UNE-P lines: the positive impact of UNE-P lines on investment in the current period (estimated as $\$757.50 * U_t$), and the negative impact from UNE-P lines in the previous period ($-\$757.50 * U_{t-1}$). *By virtue of the model's construction, the positive impact of a higher level of UNE-P lines in one period is wholly offset in other time periods.* PHOENIX 6 misinterprets this result, simply reporting the positive change and omitting (not reporting) the offsetting changes.

28. More formally, investment is defined as the change in capital stock from one period to the next. If I_t stands for investment at time t and K_t stands for the capital stock at time t , we connect the two through the following equation:

$$(0.1) \quad I_t = K_t - K_{t-1}.$$

Furthermore, we are free to substitute between the expressions of investment, I_t , and changes in capital stock, $K_t - K_{t-1}$.

29. Next, recall that the effect we are interested in measuring is the change in ILEC capital stock associated with a change in UNE-P lines. In the language of economists, we are looking for $\partial K / \partial U$, the multiplier.

30. We show that by using differences instead of levels in the estimated equations, the effect of UNE-P policy on telecom capital stock is constrained to be zero, i.e., $\partial K / \partial U = 0$. This result is true for all of the PHOENIX 6 models, but to avoid repetition we will demonstrate it for Model 3.

²⁷ Dale W. Jorgenson and James A. Stephenson, *The Time Structure of Investment Behavior in United States Manufacturing, 1947-1960*, 49 REVIEW OF ECONOMICS AND STATISTICS (February 1967): 16-27

31. Model 3, when estimated using data discussed in PHOENIX 5, describes ILEC investment by the equation:²⁸

$$(0.2) \quad I_t = \Delta K_t = 4.7 \times 10^7 + 0.75 \Delta R_t + 931.8 \Delta U_t - 6.3 \times 10^7 \Delta C - 8.0 \times 10^7 D_t - 0.035 K_{t-1}$$

Equation (0.2) states that ILEC investment in a given state in year t is \$47 million plus 75¢ for every dollar *increase* in revenues plus \$931.80 for every unit *increase* in UNE-P lines minus \$63 million for every percentage point *increase* in the cost of capital minus \$80 million if the year is 2002 minus 3.5% of the previous year's capital stock. Here we do not challenge the values of these parameter estimates but, taking them as given, examine what they imply.

32. Substituting in the definition of capital stock for investment and expressing the changes (Δ 's) as their difference in levels leads to

$$(0.3) \quad K_t - K_{t-1} + 0.035 K_{t-1} = 931.8 U_t - 931.8 U_{t-1} + b_t$$

where

$$(0.4) \quad b_t = 4.7 \times 10^7 + 0.75 R_t - 0.75 R_{t-1} - 6.3 \times 10^7 C_t + 6.3 \times 10^7 C_{t-1} - 8.0 \times 10^7 D_t$$

Equation (0.3) can be simplified to

$$(0.5) \quad K_t - .965 K_{t-1} = 931.8 U_t - 931.8 U_{t-1} + b_t$$

Recognize that in equilibrium $K_t = K_{t-1} = K$ and $U_t = U_{t-1} = U$ because the definition of a steady state or equilibrium is that the variables reproduce themselves over time (thus rendering the time subscript unnecessary).

In equilibrium, equation (0.5) can be rewritten as

$$(0.6) \quad K - .965 K = 931.8 U - 931.8 U + b .$$

Rearranging gives

$$(0.7) \quad K = \frac{0}{1 - .965} U + \frac{b}{1 - .965} .$$

33. Obviously the policy multiplier $\partial K / \partial U$ is zero, indicating that there is no ultimate effect on capital of a change in the number of UNE-P lines in Model 3. By specifying the model in differences so that the UNE-P effect is $931.8 \Delta U_t = 931.8 U_t - 931.8 U_{t-1}$, the model ensures that in equilibrium (when $U_t = U_{t-1}$) the coefficients in the numerator of

²⁸ See PHOENIX 6, Table 1, p. 14.

equation (0.7) cancel. Thus while there is an estimated initial UNE-P effect of \$931.80 in this model, subsequent reductions in capital stock eliminate it.²⁹

34. The zero policy multiplier is a feature of the Phoenix model's use of differences. With the assumption of full build-out, it is embedded in the neoclassical model put forth by Jorgenson in the 1960s.³⁰ In relying on this approach, and ignoring developments in the investment literature in recent decades, the Phoenix Center utilizes a theory that cannot answer the question they pose.

D. Econometric Issues

35. Professor R. Carter Hill of Louisiana State University argues in support of the Phoenix Center's empirical conclusions by critiquing the results presented in our previous Declaration.³¹ However, Hill fundamentally misconstrues our analysis, presenting it as a set of alternatives developed to explain the UNE-P/investment relationship. This is simply false; the alternative specifications simply demonstrate the weakness of the Phoenix estimation model in explaining the data, and the results (even when directly conflicting with the Phoenix estimates) are not claimed to represent the true relationship between investment and unbundling policy. Moreover, Hill commits analytical errors in his critique, and undertakes no data analysis to support his opinions which are, in fact, at odds with the empirical evidence. None of the five flaws Hill claims to identify in our previous Declaration stands up to scrutiny.

36. First, Hill claims that the results we presented in our previous Declaration, rather than the Phoenix Center's, likely suffer from spurious correlation. But Hill confuses "spurious correlation"³² with "spurious regression." Spurious regression occurs when two data series with trends exhibit correlation that is nothing more than the artifact of a common trend. While Hill titles a section "Spurious Correlation," he then writes about and describes "spurious regression." His discussion is irrelevant to our analysis.³³

²⁹ This analysis or slight extensions of it are directly applicable to all the Phoenix 6 Models: the formulation in differences results in a numerator of 0 in equation (0.7) and thus in a multiplier of zero for a change in UNE-P lines (and all of the other variables that enter in difference form)

³⁰ For example, in the 1967 *ECONOMETRICA* article cited by the Phoenix Center as their theoretical motivation, the equation for investment in total manufacturing on page 189 will necessarily result in a multiplier of zero for the exogenous variables. Also note that Equation 12 on page 177 assumes full build-out. Dale W. Jorgenson and James A. Stephenson, *Investment Behavior in U.S. Manufacturing, 1947-1960*, 35 *ECONOMETRICA* (April 1967) 169-220

³¹ HHB 2003

³² "If there is a theory about the joint variation of X and Y, the sign and size of the correlation coefficient may lend support to that theory, but if no such theory exists or can be devised, the correlation may be classed as nonsense correlation." The authors give an example of the high correlation between percent of marriages blessed by the Church of England and the death rate in England and Wales. JACK JOHNSTON AND JOHN DiNARDO, *ECONOMETRIC METHODS* 9-11 (1997)

³³ Irrelevant, but not uninteresting. Hill notes that time-differencing is an appropriate remedy to spurious regression. He then claims that because the Phoenix regression uses time-differenced data and our alternative specifications did not, our alternative specifications, but not the Phoenix model, suffer from spurious regression. But the regressions we estimated use the time-difference of capital as the dependent variable, just as the Phoenix Center regressions did. Hill has confused differences of regressors –

37. In our earlier Declaration, we demonstrated that the PHOENIX 5 results are spurious, as demonstrated by a lack of robustness. As discussed above, the positive relationship between UNE-P and ILEC investment which the Phoenix regression estimates is implausibly large. Moreover, it disappears (or reverses) when same-period data are used, when equally (or more) compelling model specifications are adopted, or when Resale or UNE-L lines are used in place of UNE-P lines, violating the theory upon which network sharing regulation rests. We argued that such unreliable results were the product of a statistical model that lacks economic plausibility. One essential weakness is that it restricts investment projects to just one period; investment that takes place over a number of years is ruled out by assumption. This is particularly problematic during the 2-year sample period used by Phoenix, in which one year of positive investment (2001) is followed by one year of disinvestment (2002). There are sound reasons to believe firms expand capital stock differently than they decrease it, given the nature of irreversible (sunk) investment.³⁴ Estimating a model that implicitly assumes that investment is freely reversible leaves observed investment less negative during a downturn than the (erroneously symmetric) model would predict. This occurs in the Phoenix model which falsely attributes the gap between the over-predicted disinvestment and actual disinvestment to the simultaneous growth in UNE-P lines.

38. Hill's second opinion is that it is acceptable to weight Nevada Bell equally with Pacific Bell – a carrier with 65 times the number of telephone lines – in estimating the parameters of the Phoenix Center models. We suggest a modification that weights state data by the number of BOC lines in the state. In estimating the model parameters, some states have too much influence and others have too little, if we treat all observations as equal.

39. This is a problem known as heteroskedasticity – unequal error variances. When model errors are heteroskedastic, statistical results, such as tests of the effects of UNE-P lines reported in the Phoenix Center bulletins, are not valid, as we noted in our earlier Declaration.³⁵ There is a standard correction for this, recommended and detailed in econometrics texts,³⁶ which we carried out in our analysis of the Phoenix Center models.

explanatory variables – with differences of the dependent variable. Consequently, spurious regression is not likely in either the Phoenix Center specifications or the modifications we present. At issue is whether the *right hand side variables* – revenues and UNE-P lines – should be time-differenced. As we have seen above, this specification choice depends on investment theory. It is unrelated to the problem of spurious regression.

³⁴ Specifically, depreciation rates and business cycles constrain adjustments in periods of disinvestment in ways that are not entirely symmetric to the constraints on firms expanding capital stock.

³⁵ When the equation errors are heteroskedastic, the conventionally calculated variances (which assume the errors are not heteroskedastic) are incorrect in general, and statistical inference based on them – as used by the Phoenix Center in finding UNE-P significance – is invalid. JACK JOHNSTON AND JOHN DiNARDO, *ECONOMETRIC METHODS* 162-164 (1997). The revised PHOENIX 5 substitutes the Newey-West extension of White's standard errors. These require a number of additional assumptions and have uncertain small sample properties. See RUSSELL DAVIDSON AND DAVID MACKINNON, *ESTIMATION AND INFERENCE IN ECONOMETRICS* (1993).

³⁶ GEORGE G. JUDGE ET AL, *INTRODUCTION TO THE THEORY AND PRACTICE OF ECONOMETRICS* 358-360 (1988) and JACK JOHNSTON AND JOHN DiNARDO, *ECONOMETRIC METHODS* 171-172 (1997).

The Phoenix Center conclusions with regard to the effect of UNE-P lines on capital did not hold up under this basic correction. Hill offers theoretical arguments on this subject, but ignores the empirical importance of heteroskedasticity, as revealed in his discussion of per capita regressions. Here, he confuses model specification with the correction of heteroskedasticity. Hill determines the difference between our model and that of the Phoenix Center depends in part on “whether the error assumptions for the models ... are met.”³⁷ We agree. In PHOENIX 5’s Model 1 and Model 2 these assumptions are not met and the error terms are significantly statistically heteroskedastic. The model errors in our regressions are not heteroskedastic and a basic condition for valid statistical tests is met.

40. Third, Hill notes that the explanatory power of models with different dependent variables and/or sample size cannot be compared. The first alternative model, reported in our Table A2, is estimated by ordinary least squares and has a constant term. Its R^2 is correctly calculated. This R^2 cannot be directly compared to those derived from estimation of Phoenix models. Nevertheless, the model does add additional time periods and cross sections of data and recognizes the network effects over COSA’s served by the same BOC, resulting in all of its coefficients being statistically significant (in contrast to the Phoenix results), including the negative effect of UNE-P lines on investment. Moreover, the results obtained through modifications of the Phoenix model are, again, not intended to produce more statistically compelling results. Rather, they reveal the lack of robustness of the Phoenix estimates.

41. Fourth, Hill asserts that the time-differencing of the Phoenix Center models cancels out all relevant differences in economic climates and regulatory policies over the various states. Critically, Hill ignores important regulatory changes. For instance, the Section 271 certification process could alone produce an omitted variable problem resulting in substantial bias and inconsistency in the parameter estimates, making the Phoenix statistical tests and its conclusions with regard to the UNE-P/investment relationship meaningless.

42. Finally, Hill argues that we misinterpret statistical insignificance when we observe that the model’s insignificant coefficients on revenue (and the intercept Phoenix specified) call into question the specification of the model. Hill writes, “...published empirical studies almost always include insignificant coefficients. Clearly, reporting statistical insignificance is not generally viewed as evidence of specification problems.”³⁸ The only variables significant in the Phoenix model are UNE-P and the dummy, while the only variable they included that is prescribed by the neoclassical theory Phoenix cites is revenue. Insignificance of key variables, such as revenue in the Phoenix investment equations, is symptomatic of a specification problem. Regardless, this misses the essential point, which is that theoretically compelling modifications of the Phoenix estimating equations produce results showing a statistically insignificant relationship between UNE-P lines and ILEC investment. The Phoenix Center policy conclusions about the stimulus provided by UNE-P are therefore unwarranted.

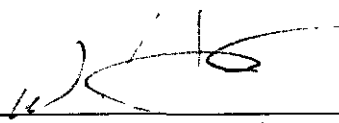
³⁷ Hill Declaration, Par. 8

³⁸ Hill Declaration, Par 16

Declaration of Thomas W. Hazlett

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 15th day of December, 2003.



Thomas W. Hazlett

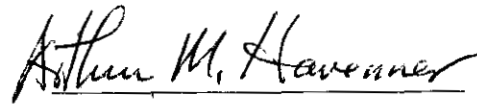
I declare, under penalty of perjury, that the foregoing is true and correct.

A handwritten signature in black ink, appearing to read "Coleman Bazelon", written over a horizontal line.

Coleman Bazelon

Executed on. December 15, 2003

I declare, under penalty of perjury, that the foregoing is true and correct.

A handwritten signature in cursive script, reading "Arthur M. Havenner", written over a horizontal line.

Arthur M. Havenner

Executed on: December 5, 2003